

ANNOUNCEMENTS OF THE MEETINGS OF THE ACADEMY
AND AFFILIATED SOCIETIES

Thursday, April 19.	The ACADEMY
Saturday, April 21.	The Helminthological Society
	The Biological Society
Wednesday, April 25.	The Medical Society
	The Geological Society
Saturday, April 28.	The Philosophical Society
Tuesday, May 1.	The Botanical Society
Wednesday, May 2.	The Medical Society

The programs of the meetings of the affiliated societies will appear on this page if sent to the editors by the eleventh and twenty-fifth day of each month.

CONTENTS

ORIGINAL PAPERS

	Page
Geology.—A spiral graph of geologic time. DAVID WHITE.....	201
Botany.—The grass genus <i>Schizachne</i> . JASON R. SWALLEN.....	203
Botany.—Some errors and mistakes in taxonomic botany. H. PITTIER.....	206
Plant Ecology.—Northward range-extensions of some southern orchids in relation to soil reaction. EDGAR T. WHERRY.....	212
Ethnobotany.—Remedial plants of Tepoztlan: A Mexican folk herbal. ROBERT REDFIELD.....	216

PROCEEDINGS

The Philosophical Society.....	227
The Anthropological Society.....	228
The Geological Society.....	231
SCIENTIFIC NOTES AND NEWS.....	232

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GEOLOGY.—*Again on Pleistocene man at Vero, Florida.*¹ OLIVER P. HAY, Washington, D. C.

In a conversation held recently between an anthropological friend and myself about the finding of human remains in supposed Pleistocene deposits, about 11 years ago, at Vero, Florida,² he used an expression which implied that the investigations made there, the reports, and the subsequent discussions, proved disastrous for those who affirmed the presence there of Pleistocene man. This remark has prompted the writer to reconsider the case, after having devoted some years previously and the years since that time to the study of the Pleistocene vertebrates and of the Pleistocene geology of North America. I anticipate to say that I regard the investigations as far from having injured the case of Pleistocene man. In the symposium cited above there was no general agreement on the main question and it would be difficult to say who were farther apart in their conclusions, the geologists or the anthropologists.

When the geologists, the anthropologists and the paleontologists arrived on the spot they beheld a low-lying tract composed of thin beds of slightly consolidated materials which looked as if they might have accumulated within a few centuries and which offered for consideration a being almost universally looked upon as a "leitfossil" of the Recent epoch. The lowest stratum in view was a marine shell bed recognized by all as belonging to the Pleistocene, but by most of the company as appertaining to a late time in this epoch—late, because (1) this bed was composed almost wholly of mollusks apparently all of existing species and because (2) it reposed on a terrace,

¹ Received March 8, 1928.

² Journ. Geol. 25: 1-62. 1917.

the youngest of at least three which, according to the prevailing theory, owed their existence to as many successive submergences during the Pleistocene beneath the sea. Overlying this marine marl was a freshwater deposit from 2 to 4 feet thick, composed of sand mingled with a little vegetable matter, some freshwater shells, many bones of land mammals, and a few of reptiles. This bed is known as No. 2. Lying upon this was found a stratum made up mostly of vegetable debris mingled with sand and containing various fossils. It formed a muck bed and was designated No. 3. It, as well as the underlying bed, No. 2, had evidently been deposited by the small stream which had, doubtless for many ages, wandered over the tract.

Now, under the conditions, material and psychological, how was it possible to find room in those thin deposits of sand and muck, for a Pleistocene creature whose skeleton and whose handiwork did not seem to differ from those of a red Indian?

Dr. Rollin T. Chamberlin, of the University of Chicago, made the main reports in opposition to the asserted presence of Pleistocene man.³ He granted that the human bones found in strata Nos. 2 and 3 had been covered up as those deposits were laid down. "This formation [No. 2] contains human bones essentially *in situ* beyond reasonable doubt, together with the scattered bones of many extinct vertebrates."⁴

One can not be mistaken in saying that Chamberlin's efforts were expended in the endeavor to prove that the deposits containing evidences of man were of comparatively recent time. A feature which he regarded as of high importance was the discovery, in a bog immediately west of the fossiliferous locality, of a stratum from 2 to 4 feet thick, of a dark brown to black sandstone firmly indurated by oxides of iron and manganese. It was thought that the accumulation and induration of this may well have required considerable time. On examining the deposit where remains of man had been found (Sellards' No. 2 and No. 3) Chamberlin found numerous pebbles, "balls" and "cannon balls" of a similar dark sandstone. These he explained as fragments which had been brought down the creek and rolled on their passage into their globular form. He accordingly argued that the deposits holding the fossils and these balls were probably much more recent than the sandstone stratum of the bog. Also in his second report he retained his opinion that the sandstone had furnished the

³ Journ. Geol. 25: 25-39; 667-683. 1917.

⁴ Journ. Geol. 25: 27-28. 1917.

rough materials for the balls; hence "the oldest fill in the creek channel is notably younger than the bog deposit." However, one may argue on the other side. As is well known, sandstones saturated with water containing salts of iron and manganese, in the presence of organic materials may harden rapidly. On the west coast of Florida human skulls and skeletons have been found embedded in masses of bog iron, and the bones themselves are sometimes converted into limonite; and yet we are assured that these human remains are of comparatively recent age.⁵ Nor is it necessary to suppose that irregular blocks of sandstone were rolled into balls as they were pushed down stream. Round concretionary masses are common occurrences in bog iron deposits and the formation of these may be effected rapidly. Released by erosion they would need no abrasion and would perhaps increase in size while rolling. It is still more probable, however, that the balls observed at Vero were engendered at the spot where they were discovered. At any rate, the bog sandstone and the creek beds may have been laid down in a relatively short, probably simultaneous time.

In his first report Dr. Chamberlin regarded the bog sandstone as also the source of most of the bones which were found in the creek beds. The animals had, he thought, lived, died, and left their skeletons in the sand before it had become consolidated. Later these bones had been eroded out and transported to their final resting place with the balls just described. This conception appeared to relegate the animals back in the Pleistocene to any convenient time and the deposition of the creek beds forward to any required late date. However, when on Dr. Chamberlin's second visit no bones could be found, either in the bog sandstone or in the creek on their way to the fossil-bearing beds, this hypothesis was abandoned. "The solution of the riddle of the mixture of bones of extinct animals with human bones and pottery was therefore sought on other lines." The critical problem was left "still crying for a satisfactory explanation."

In seeking a solution of the problem Dr. Chamberlin fell into various errors. He appeared obliged to assume a late date for the animals and for man. "Both of these deposits [No. 2 and No. 3] were late in the history of the formations of the region, and the oldest of these formations bears both a paleontological and a topographical aspect of recency."⁶ In speaking of the marine coquina deposit he says that it does not bear evidence of great age, its shells being all of living species;

⁵ Bur. Ethn. Bull. 33: 64-66.

⁶ Journ. Geol. 25: 673. 1917.

and he cites the assignment, by geologists, of the terrace on which the coquina reposes to the late Pleistocene. It would have been instructive to tell us what Pleistocene deposits of mollusks are not composed of practically all existing species. The Upper Pliocene of England contains from 90 to 95 per cent of living species of mollusks and this Upper Pliocene corresponds to the lower portion of the American Pleistocene. Dr. Ralph Arnold⁷ found in the Pleistocene Upper San Pedro beds, near Los Angeles, abundant molluscan species of which only 9.5 per cent were extinct. In Dr. W. C. Mansfield's list of mollusks⁸ are recognized 61 species. Of these there are 19 species (exclusive of young and imperfect specimens) which are not indicated as occurring in the recent fauna. Certainly not all of these are extinct; but no one, I think, can affirm that none of them are. If 6 out of this lot are extinct the percentage will be 10; if only 3 are extinct the percentage will be 5. Another piece of evidence in favor of the early Pleistocene age of the Anastasia marl is the discovery in it of a bone of a camel, as reported by Sellards. What stands in the way of referring the Anacostia marl to the lower Pleistocene?

Dr. Chamberlin fell also into the error of accepting without further investigation the view that the terrace was a late Pleistocene marine formation. It may be permitted to call it the youngest terrace, but that does not fix its place in the epoch. Neither it nor the terraces above it are of marine origin. This is demonstrated by the total absence of marine fossils in all of them, except where local sinkings of the coast have occurred since the formation of the last terrace; and these depressions amount to only a few feet. Had those terraces been submerged they would have been filled with mollusks. Similar terraces are common in Europe along the coasts and many rivers, and on our western coast, and they abound in fossils.⁹ Our east coast terraces are of river origin and were laid down in probably the earliest Pleistocene when the continent stood at a much higher elevation than now. It was probably at this time when the now submarine channel of Hudson River was excavated and the channels of many of our other great rivers were cut deep, to be refilled at a later time. Drs. T. C. Chamberlin and R. D. Salisbury¹⁰ reject the marine theory of the terraces along our Atlantic coast. The reader ought to peruse, on

⁷ Mem. Calif. Acad. Sci. 3. 1903.

⁸ Fla. Geol. Surv., 9th Ann. Rept., p. 78.

⁹ See HAUG, *Traité de géologie*, and ARNOLD, Mem. Calif. Acad. Sci. 3. 1903.

¹⁰ *Text Book of Geology* 3: 452-454. 1906.

pages 412 to 414 of the 15th volume of the *Journal of Geology*, a review signed T. C. C.,¹¹ in order to obtain that writer's opinion about the marine origin of the terraces.

Dr. R. T. Chamberlin further assumed that the animal remains were swept by floods into the positions they occupied. No proof can be afforded that a single bone was thus carried into those creek deposits, although this transportation would not involve their belonging to a Pleistocene stage older than that of the deposit No. 2. However, the animals found there probably died not far distant.

In his efforts to prove the recency of the mammalian remains and the deposits at Vero, Dr. Chamberlin hit upon two ideas which have come to other minds since that time, if not before, and which appear to have given them much comfort. These are (1) that the southern climate was better adapted for mammalian life than that of the northern States and (2) that the mammalian fauna existed longer there than it did elsewhere. These notions appear to inspire a sort of poetical feeling, for the conditions are spoken of almost always as "that genial southern clime" and the animals are tenderly mentioned as "lingering longer there."

Doubtless during the Wisconsin glacial stage the mammals of the northern regions were forced southward, even into Florida and Texas. Reindeer reached Kentucky, musk-oxen migrated to Oklahoma, *Elephas boreus* (*E. primigenius*, of authors) probably strayed as far south as Florida and Texas, and so with many other northern species. When, however, the glacier retreated these animals did not remain there, but they kept as near the glacial front as they found it comfortable. Mastodons and certain elephants doubtless lived in Florida during the wane of the Wisconsin stage, but there is not a whit of evidence that they lived there at a later time than they did in New York or Michigan. For a reindeer and a musk-ox the genial climate is the one which furnishes plenty of snow and the kind of food they need.

Now as to the matter of lingering, it is a certainty that many of the mammals found in the Pleistocene beds at Vero, Peace Creek, Melbourne and many other places in Florida did linger there and elsewhere and become extinct only at a later time. *Myiodon*, one or more species of tapirs, the great ox *Bison latifrons*, and *Equus complicatus* appear to have lived on until the Sangamon interglacial. The American mastodon, *Elephas columbi*, and the giant beaver lived long after

¹¹ Journ. Geol. 15: 412-414. 1907.